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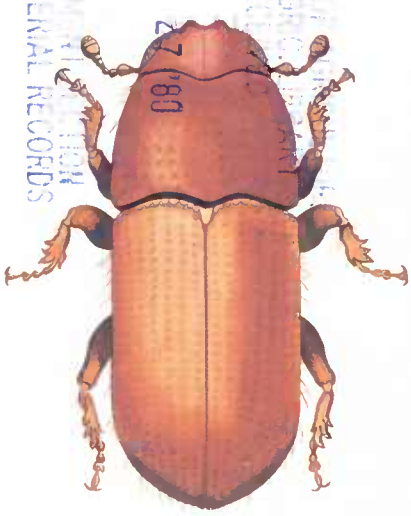
Southern Pine
Beetle Handbook

A Field Guide for Ground Checking Southern Pine Beetle Spots



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In 1974 the U.S. Department of Agriculture initiated the Combined Forest Pest Research and Development Program, an interagency effort that concentrated on the Douglas-fir tussock moth in the West, on the southern pine beetle in the South, and on the gypsy moth in the Northeast. The work reported in this publication was funded in whole or in part by the program. This manual is one in a series on the southern pine beetle.

A Field Guide for Ground Checking Southern Pine Beetle Spots

by
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Introduction

The job of locating and controlling the southern pine beetle (SPB) takes the teamwork of three separate field operations—aerial survey, ground check, and direct control. Aerial surveys locate many areas with dead or dying pines believed to harbor SPB. Some are active beetle spots; others are not. Only by checking from the ground can we be sure. So, on the basis of tree symptoms visible from the air, aerial survey crews assign each spot a high, medium, or low priority for ground checking. Ground check crews then visit newly detected spots, giving first attention to high priority areas. Your responsibility, as a member of the ground check crew, is to see firsthand the extent of beetle activity in each spot and to determine if further tree killing is likely to occur. This handbook shows how to recognize various stages of SPB attack, how to decide if control is needed, and how to mark buffer strips for control crews.

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Locating SPB Spots from Ground Level

To find newly detected spots, use a map and compass, if necessary, to arrive at the general area indicated by the aerial survey team. Once there, look for a group of yellow- or red-topped pines (fig. 1). Spots that cannot be found after a reasonable search should be rechecked during the next aerial survey flight. The aerial crew may be able to correct errors in plotting or to pinpoint landmarks guiding you to the spot.

Figure 1.—Red-topped pines indicative of SPB spot.

How to Identify SPB Attacks

Like any living thing, pines may die from a variety of causes. But how can you tell if they were killed by SPB? The best way is to remove sections of bark from trees with fading (yellow) foliage or from trees with bark just starting to loosen. Look for the winding, S-shaped tunnels or galleries made only by SPB adults (fig. 2). SPB galleries are filled with a sawdustlike material (frass) left behind by feeding adult beetles.

In pines just coming under attack, galleries are not yet present. The first symptom of SPB in this case will usually be pitch tubes in bark crevices. These glossy masses of resin mark where the adult beetles bore into the trunk of a tree. SPB pitch tubes are soft and pink when fresh, becoming hard and white or yellow with age

Figure 2.—Galleries of SPB adults together with white larvae.

(fig. 3). But remember, pitch tubes—alone—are not reliable indicators of SPB attack because other bark beetles also leave them.

For a couple of weeks after attack, you may find SPB adults within the S-shaped galleries where they lay eggs. The SPB itself is surprisingly small, considering the amount of damage it can do. The adult beetle measures only 1/8 of an inch long and is black or dark brown. Because of their small size, you may have difficulty recognizing SPB adults among the many other bark-inhabiting insects. Again, the S-shaped galleries provide telltale evidence that SPB killed the tree, even when the beetles themselves are no longer present.

The southern pine beetle is not the only destructive bark beetle in the South. Other beetles, including *Ips* beetles and the black turpentine beetle (BTB), also kill pines, but usually in small, scattered outbreaks not requiring control. This means that you must be able to tell the difference between SPB attacks and those of other bark beetles. Identification can be difficult because the various beetles are similar in many ways.

Yet there are unmistakable differences. For instance, the black turpentine beetle is about ¼ of an inch long, which makes it much larger than the southern pine beetle. Also, the BTB normally limits its attacks to the lower 10 feet of the trunk, while the SPB attacks at almost any height on the tree. Pitch tubes of the BTB usually are reddish and much larger than those of the SPB (fig. 4). The black turpentine beetle's galleries follow no distinct pattern.

Differences between SPB and *Ips* beetles are less obvious because the insects are similar in size. Adult galleries provide the best clue for recognizing *Ips* attacks. They are long, straight tunnels often joining to form a Y or H shape. *Ips* galleries usually are not packed with frass (fig. 5). Keep in mind that *Ips* and black turpentine beetles may occur in the same tree as the southern pine beetle.

Figure 3.—Pitch tubes of SPB.

Seasonal Variation in Attack Symptoms

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Figure 4.—Pitch tubes of black turpentine beetle.
Figure 5.—Galleries of the adult *Ips* beetle.

The time it takes SPB to grow from eggs to adults varies seasonally, as does the time it takes for symptoms of beetle attack to appear in infested pines. Judging the presence or absence of SPB and the stage of development during the winter months can be a difficult task. Foliage on trees attacked in cold months may remain green for long periods, although such trees quickly lose their needles once foliage discoloration begins. Because the beetle needs 2–4 months to mature during cold months, some winter-killed pines with bare crowns may still contain SPB. Also, the insects in winter often reattack the top and base of a tree already containing developing broods. This leaves different beetle life stages at different heights in the same tree. Because of these difficulties, no attempt has been made to categorize infested spots for the winter months.

Stages of Beetle Attack During the Summer

SPB attack sequence and developmental time are more predictable from May to October, and the appearance of beetle-killed pines changes with a distinct pattern. On the basis of these facts, three categories for beetle-infested pines have been established, reflecting various stages of attack. The number of trees in each stage of attack—and where the trees are located in a spot—is the key to whether a SPB spot is likely to spread in warm weather. It is essential, then, that you learn to recognize these three stages to correctly determine the need for control.

Stage 1—Pines With Fresh Attacks

When SPB bore into a tree, they produce chemicals attracting other beetles to the tree. This sets off a chain reaction. The attractants usually bring together more than enough beetles to kill the pine, and excess beetles spread to nearby trees. They, too, give off the attractant, which calls in still more SPB. The infestation grows. Because only freshly attacked trees are sources of attractant, it is important to identify their number and location. Only then can you determine if the spot is likely to spread. The following characteristics identify trees with fresh attacks:

- *Foliage* . . . appears normal (green).
- *Pitch tubes* . . . are soft and white or light pink and usually sticky to the touch (fig. 6). SPB normally attack first at heights of 10–20 feet above ground. So, if there are no pitch tubes visible at eye level, look higher on the trunk. In severely stressed pines, pitch tubes may not appear. Instead, reddish boring dust appears in bark crevices, on the leaves of shrubs, and in spider webs at the base of the tree (fig. 7).

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Figure 6.—Fresh pitch tube and SPB adult on stage 1 tree.

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Figure 7.—Boring dust in spider webs at base of stage 1 tree.

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• *Checkered beetles (clerids)* . . . may be seen crawling about on the trunks of freshly attacked pines (fig. 8). They are common predators of SPB and respond to SPB attractant.

• *Bark* . . . remains tight and hard to remove.

• *Color of wood surface* . . . is white like that of unattacked trees, except close to new adult galleries, where it is brown (fig. 9).

Figure 8.—Adult checkered beetles on stage 1 tree.

Figure 9.—White-colored wood of stage 1 tree with SPB adult gallery.

Stage 2—Pines With Developing SPB Broods

Soon after adult beetles have overcome a tree, they stop producing attractant. Eggs hatch, and small, white SPB larvae start feeding in inner bark mines, which are mixed among the S-shaped adult galleries (fig. 2). As larvae develop, they move into the outer bark, where they eventually change into white pupae and then into brown or black adults. It is important to realize that the beetle has these various forms. To see the later beetle stages, carefully shave away outer layers of bark with an axe or machete (fig. 10). Other features of trees with developing brood are:

- *Foliage* . . . is green on most trees containing larvae, but may fade to yellow or turn red before the new

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Figure 10.—Shaved bark with SPB larvae and pupae in outer bark of stage 2 trees.

Figure 11.—Ambrosia beetle dust at base of stage 2 tree.

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generation of beetles emerges from the tree. Foliage color varies greatly by season and among individual trees, so it is not always a good indicator for this stage.

- *Pitch tubes* . . . are white and hardened, resembling popcorn (fig. 3).
- *Exit holes* . . . may appear at this stage and mark where parent beetles have left the tree. They are round holes about the size of a pencil lead.
- *Ambrosia beetle dust* . . . is white and begins to appear in small to moderate amounts around the base of the tree (fig. 11). It is not present in stage 1 trees.
- *Bark* . . . is loose and easy to peel away from the trunk.
- *Color of wood surface* . . . is light brown (fig. 12). It may shade into dark brown with blue or black sections infested by staining fungi.
- *Checkered beetle larvae* . . . show up in SPB galleries in the bark. The larvae are pink or reddish and about ½ inch long (fig. 13).

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Figure 12.—Brown wood associated with bark beetle mining in stage 2 tree.

Figure 13.—Checkered beetle larvae in inner bark of stage 2 tree.

Stage 3—Pines Killed and Vacated by SPB

After maturing in the bark, new adult beetles bore their way out and fly off to attack another pine. A tree is termed "inactive" when no SPB of any stage can be found in it. Other features of inactive trees include:

- *Foliage* . . . of most trees is red and needles may have started dropping.
- *Ambrosia beetle dust* . . . is abundant at the base of the tree and is now off white or cream colored (fig. 14).
- *Pitch tubes* . . . are hard and yellow, crumbling easily in your fingers (fig. 15).
- *Exit holes* . . . are numerous (fig. 15).
- *Bark* . . . is very loose and easily removed.
- *Color of wood surface* . . . is dark brown to black with SPB galleries often obscured by the coarse, fibrous borings of sawyer beetle larvae (fig. 16).
- *Checkered beetle larvae or pupae* . . . are purple and occur in pockets within the outer bark shortly after the SPB brood leaves.

Figure 14.—Ambrosia beetle dust at base of stage 3 tree.

Figure 15.—SPB pitch tubes and exit holes through bark of stage 3 tree.

Figure 16.—Wood discoloration caused by insect and fungal activity in stage 3 tree.

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Collecting Spot Expansion Data

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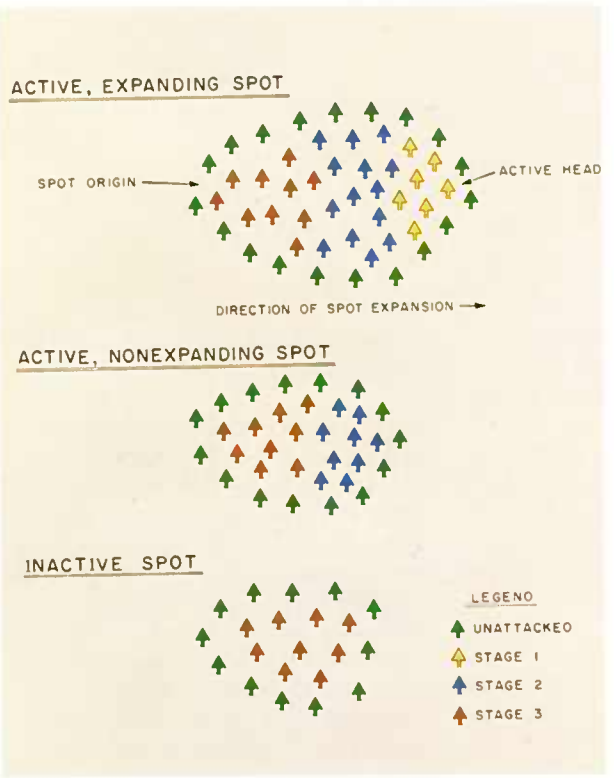

Figure 17.—Three kinds of SPB spots.

Is the new spot you have located a threat to grow larger? It may well be. The southern pine beetle can readily spread if it has three conditions: Attractants from stage 1 trees, continuous emergence of attacking adult beetles from stage 1 and stage 2 trees, and pines to attack (fig. 17). During the summer, spots with no stage 1 trees are not likely to expand because attractants are no longer present. And spots with only stage 3 trees—since beetles have already left—need no control at all. The following steps, to be used between May and October, explain how to collect information for use in the control priority guide:

1—Walk completely around the spot and look for stage 1 trees, which indicate the area of most recent beetle activity. Areas with stage 1 pines are called "active heads". Check to see if the spot is expanding in more than one direction. Large spots can have more than one active head.

2—Determine the number of stage 1 and 2 trees. For large spots that have more than 50 trees, it is not necessary to examine each tree. Just walk the boundaries and estimate the number of these trees in the spot.

3—From a location about 20 feet in front of the active head or heads, determine the pine basal area (a measure of stand density) in square feet per acre. A 10-factor prism is useful for this purpose.

4—Note whether most trees in the spot are pulpwood (less than 9 inches in diameter) or sawtimber size (more than 9 inches in diameter).

5—Using the Control Priority Guide from the next section of this handbook, determine the control priority for the spot.

6—Flag a trail back to the nearest road or landmark for the control crew.

Using the Control Priority Guide

To assign a control priority using information gathered at the spot, turn to table 1 (see page 18). Four keys to spot growth (A, B, C, and D) appear in the left-hand column. For each of these, select from the middle column the classification matching your spot. Select from the right-hand column the risk-rating points for that classification. For Key A, for example, if your spot classification is "present," your risk-rating choice would be 30 points. Take one number for each key and add them together. This gives you the total risk-rating points for your spot.

If the total of risk rating points is 70 or greater, the spot is assigned a high priority for control. Risk totals between 40 and 60 indicate a medium priority for control, and totals of 30 or less signal a low control priority.

A Word on Control Priorities

Effective control requires prompt removal of the buffer strip and stage 1 trees. For large spots, this should be done first, then you can remove the other infested trees in the spot. Salvaging stage 3 trees is not critical to control, but can be done later.

Decisions on controlling SPB spots depend not only on the control priority, but also on the availability of crews and equipment, access to the spot, and market value of beetle-killed pine. If possible, high priority spots should be controlled promptly or they will spread, while medium priority spots can be handled as time permits. A low priority spot may need no control. Since it is uncertain what will happen in medium or low priority spots, you should recheck them every 4–6 weeks until they are controlled or become inactive. During major SPB outbreaks, aerial surveys are the most practical way to monitor uncontrolled spots after the first ground check.

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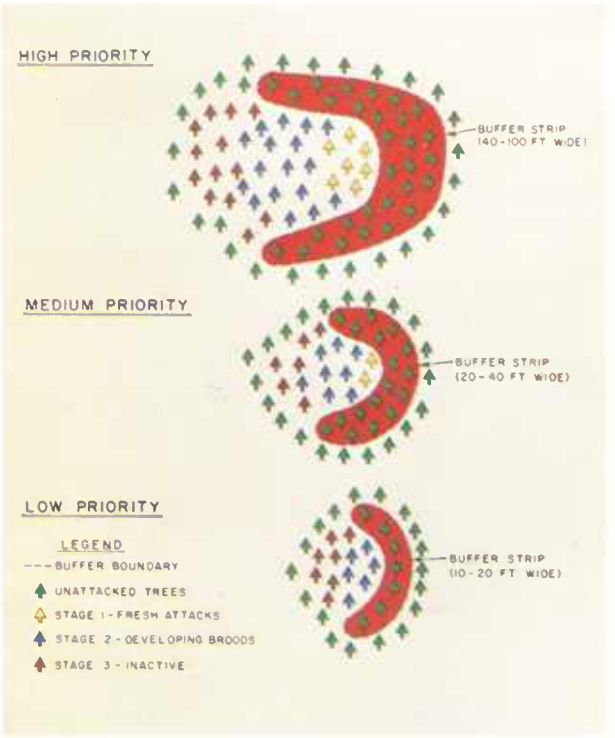

Figure 18.—Location of buffer strips.

No matter which means of control is used, success hinges upon treating all stage 1 trees. The best insurance is to cut a buffer strip of uninfested pines around the active head of a spreading spot. This tactic interrupts the beetles' flow of attractants and stops their advance. The buffer strip also provides a margin of error, just in case attacked pines were initially overlooked or the spot has expanded since then.

A buffer strip 10–40 feet wide is enough for medium and low priority spots and for high priority spots with fewer than 30 trees. But a buffer strip 40–100 feet wide is needed for large high priority spots (fig. 18). As a rule of thumb, the number of trees in the buffer strip should not be more than the combined number of stage 1 and stage 2 pines in the spot being treated. The buffer strip should enclose all stage 1 and stage 2 trees and be widest in the direction that the spot is expanding.

If control is planned within 2 weeks after the ground check, mark the buffer strip at the time of the first ground check. If control is not planned this soon, wait until just before the control date to mark the buffer strip or carefully recheck its boundaries before treatment. Otherwise, the spot may enlarge beyond the buffer zone before the control starts.

Checklist

- Verify that trees were killed by SPB.
- See if any stage 1 trees are present.
- Mark and count all stage 1 and stage 2 trees.
- Measure basal area of pine about 20 feet in front of the active head or heads.
- Note whether the stand contains mainly pulpwood or sawtimber.
- Using table 1, determine the control priority.
- If control is to be applied promptly, mark the buffer strip of uninfested pines around the active head.
- Flag a route back to the nearest road or landmark.
- Report ground check information promptly.

Table 1.—*Guide to southern pine beetle spot growth and control priorities (May through October)*

Key to spot growth	*Your spot's classification*	*Risk-rating points*
A. Stage 1 trees	absent	0
	present	30
B. Stage 1 and 2 trees	1–10	0
	11–20	10
	21–50	20
	more than 50	40
C. Pine basal area (ft^2/acre) (or stand density) at active head or heads	less than 80 (low density)	0
	80–120 (medium density)	10
	more than 120 (high density)	20
D. Stand class by average d.b.h. (in inches)	pulpwood (9 in or less)	0
	sawtimber (more than 9 in)	10
	Total [1]	

[1] If total is 70–100 control priority is High. If total is 40–60 control priority is Medium. If total is 0–30 control priority is Low.

Glossary

southern pine beetle—*Dendroctonus frontalis,* a bark beetle identified by the S-shaped galleries it makes beneath the bark of attacked pines.

spot—A group of dead or dying trees infested by the southern pine beetle.

spot growth—The natural expansion of untreated spots as additional live trees on the outer edge of a spot become infested.

stage 1 pine—Infested pine showing symptoms of fresh attacks by SPB.

stage 2 pine—Infested pine with developing broods (larvae, pupae, or new adults) of SPB.

stage 3 pine—Pine killed by SPB from which all broods have emerged.

active spot—SPB infestation in which one or more of the attacked trees contain beetles or brood.

inactive spot—SPB infestation in which the beetles in all of the attacked trees have completed development and emerged.

active head of spot—That portion of a SPB spot containing beetles in the process of attacking live trees.

buffer strip—A group of live uninfested pines, adjacent to the most recently infested trees in a spot, that is felled to assure effective control.

Ips beetles—A group of related pine-killing beetles that can be distinguished from SPB by the unfilled Y- or H-shaped galleries made by attacking parent beetles.

black turpentine beetle—*Dendroctonus terebrans,* a large bark beetle commonly found attacking the lower trunks of pines, producing large reddish pitch tubes.

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